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Report of the individual review of the annual submission of Sweden submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Introduction and summary

1. This report covers the review of the 2013 annual submission of Sweden, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 2 to 7 September 2013 in Stockholm, Sweden, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Mario Contaldi (Italy); energy – Mr. Amit Garg (India); industrial processes and solvent and other product use – Ms. Elsa Hatanaka (Japan); agriculture – Mr. Mahmoud Medany (Egypt); land use, land-use change and forestry (LULUCF) – Mr. Lucio Santos (Colombia); and waste – Ms. Maryna Bereznytska (Ukraine). Mr. Contaldi and Mr. Garg were the lead reviewers. The review was coordinated by Mr. Daniel Hooper and Mr. Javier Hanna (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), a draft version of this report was communicated to the Government of Sweden, which provided comments that were considered and incorporated, as appropriate, into this final version of the report. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified. In its comments to the draft review report, Sweden underlined that the term "next annual submission" used in this review report shall be interpreted as the next annual submission after the review report has been published.

3. In 2011, the main greenhouse gas (GHG) in Sweden was carbon dioxide (CO_2), accounting for 79.3 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by nitrous oxide (N_2O) (10.9 per cent) and methane (CH_4) (8.1 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.7 per cent of the overall GHG emissions in the country. The energy sector accounted for 73.3 per cent of total GHG emissions, followed by the agriculture sector (12.6 per cent), the industrial processes sector (10.8 per cent), the waste sector (2.8 per cent) and the solvent and other product use sector (0.5 per cent). Total GHG emissions amounted to 61,447.45 Gg CO_2 eq and decreased by 15.7 per cent between the base year[2] and 2011. The expert review team (ERT) concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable.

4. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as Annex A sources), emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, elected activities under Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

5. Additional background data on recalculations by Sweden in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

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[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions include emissions from Annex A sources only.

Table 1

Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year[a] to 2011

			Gg CO_2 eq								*Change (%)*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year[a]–2011*
Annex A sources		CO_2	56 954.05	56 954.05	58 871.85	54 145.37	50 005.53	46 518.44	52 368.55	48 725.69	–14.4
		CH_4	6 938.23	6 938.23	6 827.46	6 252.04	5 269.83	5 169.81	5 076.20	4 984.89	–28.2
		N_2O	8 369.65	8 369.65	8 069.77	7 602.32	6 955.08	6 803.07	7 030.63	6 680.06	–20.2
		HFCs	132.12	4.15	132.12	567.89	866.62	868.52	845.24	813.42	515.7
		PFCs	343.43	376.82	343.43	240.52	225.05	35.33	158.21	182.95	–46.7
		SF_6	126.68	107.49	126.68	93.59	83.87	80.53	72.59	60.43	–52.3
KP-LULUCF	Article 3.3[b]	CO_2					2 109.20	1 854.06	1 634.27	1 654.47	
		CH_4					NO	NO	NO	NO	
		N_2O					2.46	2.56	2.63	2.69	
	Article 3.4[c]	CO_2	NA				–35 751.49	–35 503.11	–33 680.04	–37 631.59	NA
		CH_4	NA				13.16	2.53	0.65	2.06	NA
		N_2O	NA				50.34	45.88	65.83	43.67	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2
Greenhouse gas emissions by sector and activity, base year[a] to 2011

			Gg CO_2 eq							*Change (%)*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year[a]–2011*
Annex A		Energy	53 669.62	53 669.62	55 463.51	50 583.57	46 400.66	44 623.32	48 871.57	45 014.72	–16.1
		Industrial processes	6 443.55	6 329.78	6 644.15	6 811.84	6 804.30	4 985.56	6 810.30	6 660.58	3.4
		Solvent and other product use	332.49	332.49	308.55	277.54	287.76	269.97	288.93	288.93	–13.1
		Agriculture	8 997.22	8 997.22	8 721.62	8 313.10	7 913.66	7 705.26	7 782.46	7 770.64	–13.6
		Waste	3 421.27	3 421.27	3 233.47	2 915.69	1 999.58	1 891.59	1 798.17	1 712.58	–49.9
		LULUCF	NA	37 184.46	–31 576.11	–35 541.44	–32 826.30	–32 891.41	–30 700.61	–35 231.66	NA
		Total (with LULUCF)	**NA**	**35 565.93**	**42 795.20**	**33 360.28**	**30 579.67**	**26 584.29**	**34 850.82**	**26 215.78**	**NA**
		Total (without LULUCF)	**72 864.16**	**72 750.39**	**74 371.31**	**68 901.73**	**63 405.97**	**59 475.70**	**65 551.42**	**61 447.45**	**–15.7**
		Other[b]	NO	NO	NO	NO	NO	NO	NO	NO	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation					–884.51	–915.04	–899.22	–897.97	
		Deforestation					2 996.17	2 771.66	2 536.12	2 555.13	
		Total (3.3)					**2 111.66**	**1 856.62**	**1 636.90**	**1 657.17**	
	Article 3.4[d]	Forest management					–35 687.99	–35 454.70	–33 613.56	–37 585.86	
		Cropland management	NA				NA	NA	NA	NA	NA
		Grazing land management	NA				NA	NA	NA	NA	NA
		Revegetation	NA				NA	NA	NA	NA	NA
		Total (3.4)	**NA**				**–35 687.99**	**–35 454.70**	**–33 613.56**	**–37 585.86**	**NA**

Abbreviations: KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 12 April 2013; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. Sweden also submitted the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (KP-LULUCF activities), accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 12 April 2013.

7. During the review week, Sweden officially submitted revised emission estimates on 6 September 2013 in response to questions raised by the ERT (see paras. 23 and 67 below). The values used in this report are based on the values contained in the revised emission estimates submitted on 6 September 2013.

8. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

9. Table 3 contains the ERT's overall assessment of the annual submission of Sweden. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the annual submission

		General findings and recommendations
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		
Annex A sources[a]	Complete	Mandatory: none
		Non-mandatory: CO_2 emissions from transport (oil) (see para. 25 below); CH_4 emissions from aluminium production (see para. 45 below); GHG emissions from other (waste) (see para. 81 below)
Land use, land-use change and forestry[a]	Complete	Mandatory: none
		Non-mandatory: none
KP-LULUCF	Complete	
The ERT's findings on recalculations	Generally consistent	The ERT identified minor issues of consistency

		General findings and recommendations
and time-series consistency in the 2013 annual submission		between the LULUCF estimates of CO_2 removals in managed land (cropland, grassland and settlements) converted to forest land compared with the CO_2 estimates of afforestation and reforestation under the KP-LULUCF activities. The ERT recommends that Sweden revise the implications of the use of two different extrapolation methods for the AD used to calculate the removal estimates for the LULUCF categories and the KP-LULUCF activities (see paras. 76, 88 and 89 below)
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Sufficient	The ERT noted that Sweden has applied tier 2 QC activities in the energy and industrial processes sectors and tier 1 QC procedures in the other sectors. Therefore, the ERT reiterates the encouragement from the previous review reports that Sweden expand its tier 2 QC activities to cover the agriculture, LULUCF and waste sectors
The ERT's findings on the transparency of the 2013 annual submission	Not sufficient	The ERT identified transparency issues in all sectors of the inventory, mainly linked to insufficient descriptions in the NIR of the methodologies used and/or the outputs of the national models used in the calculations. During the review, the Party provided the necessary explanations and background information to the ERT. The main issues identified relate to: the energy and industrial processes sectors, regarding the allocation of emissions from iron and steel (see paras. 39, 40 and 52–54 below); the industrial processes sector, regarding F-gas collection/destruction and technology for emissions reduction in nitric acid production (see paras. 50 and 51 below); the agriculture sector, regarding the country-specific fractions of nitrogen input to soils used to estimate the N_2O emissions from agricultural soils, the description of the model used for the nitrogen content residue and the use of actual data or standard data for the estimates of N_2O from direct soil emissions (see paras. 67 and 68 below); the LULUCF sector, regarding the drivers of the inter-annual fluctuations in CO_2 emissions from cropland remaining cropland (see para. 77 below); the waste sector, regarding the missing flow chart describing the different solid waste treatment types, including biological treatment, and the country-specific parameters used for the first order decay model (see para. 84 below); and the KP-LULUCF

	General findings and recommendations
	activities, regarding the reporting of the carbon stock changes by strata as established in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (see table 6 below)

Abbreviations: AD = activity data, Annex A sources = sources included in Annex A to the Kyoto Protocol, EU = European Union, F-gas = fluorinated gas, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NE = not estimated, NIR = national inventory report, QC = quality control.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

10. The NIR and additional information provided by Sweden during the review described the national system for the preparation of the inventory. The Swedish Ministry of the Environment is the designated single national entity with overall responsibility for the national inventory. The Swedish Environmental Protection Agency (SEPA), under the authority of the Ministry of the Environment, is responsible for: coordinating the preparation of the inventory; performing the final quality assurance/quality control (QA/QC) activities; submitting the inventory to the European Union (EU) and to the UNFCCC; and publishing the national inventory.

11. The Swedish Environmental Emissions Data (SMED) consortium consists of four partner organizations: Statistics Sweden, the Swedish Meteorological and Hydrological Institute, the Swedish Environmental Research Institute and the Swedish University of Agricultural Sciences (responsible for the inventory for the LULUCF sector). SMED is responsible, under a nine-year (2006–2014) contract with SEPA, for the preparation of the inventory for all sectors, including the inventory development process, the choice of methods and emission factors (EFs), and standard QA/QC procedures. SMED receives activity data (AD) and background documentation from national agencies and institutions and produces the inventory estimates. Several other agencies and organizations are also involved in the preparation of the inventory, for example: for the energy sector – the Swedish Energy Agency and the Swedish Transport Administration; for the industrial processes and solvent and other product uses sectors – the Swedish Chemicals Agency; for the agriculture sector – the Swedish Board of Agriculture; and for the waste sector – the Swedish Association of Waste Management. All the above-mentioned agencies are part of the national system and their functions are clearly described in the NIR. The roles and responsibilities of the organizations involved in the inventory preparation process are clearly defined within the national system, as established by Ordinance Concerning Climate Reporting (2005:626). The long-term contract between SEPA and SMED ensures the availability of sufficient capacity and resources and the performance of any new tasks that may be necessary, through specific subcontracts. A new contract starting from 2015 onwards is currently under negotiation.

12. The ERT commends Sweden for its well-organized national system, which ensures the provision of the up-to-date available scientific expertise in each sector, high-quality AD

and appropriate data handling for the emission estimates, as well as its flexibility to perform any new tasks that may be necessary for inventory preparation. Nevertheless, the ERT notes that at least two years are usually required to implement any recommendation from the annual review reports where this implies some change in methodology, EFs or AD. Therefore, the ERT recommends that Sweden improve the national system in a way that would enable it to implement the recommendations provided in the annual review reports in time for its next annual submission. In its comments to the draft review report, Sweden underlined that the term "next annual submission" used in this review report shall be interpreted as the next annual submission after the review report has been published.

Inventory preparation

13. Table 4 contains the ERT's assessment of Sweden's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by Sweden

		General findings and recommendations
Key category analysis		
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes	The key category analysis has been performed at high a level of aggregation for some sectors and does not allow to understand the particular importance of emissions for some categories of these sectors. The ERT encourages Sweden to follow a more disaggregated key category analysis, in particular for the transport categories in the energy sector and the LULUCF sector, in its next annual submission
Approach followed?	Tier 1 and tier 2	Sweden uses both tier 1 and tier 2 key category approaches for all sectors in the inventory
Were additional key categories identified using a qualitative approach?	No	
Has Sweden identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes	
Does Sweden use the key category analysis to prioritize inventory improvements?	Yes	
Are there any changes to the key category analysis in the latest submission?	No	

		General findings and recommendations
Assessment of uncertainty analysis		
Approach followed?	Tier 1	
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	No	In the waste sector, the default uncertainty values were used for the estimation of the key categories, therefore not reflecting the real uncertainty of the country-specific parameters used in the inventory estimates. The ERT recommends that Sweden further investigate the uncertainty of country-specific parameters and EFs used and improve the uncertainty analysis in its next annual submission
Quantitative uncertainty (including LULUCF) in 2011	Level = 32.0% Trend = 6.8%	
Quantitative uncertainty (excluding LULUCF) in 2011	Level = 4.0% Trend = 1.9%	

Abbreviation: EFs = emission factors, ERT = expert review team, LULUCF = land use, land-use change and forestry.

Inventory management

14. Sweden has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. Sweden's QA/QC system includes a "national peer review" performed every year for the key categories by the sectoral agencies and organizations: for the energy sector, it is performed by the Swedish Energy Agency and the Swedish Transport Administration; for the industrial processes and solvent and other product use sectors, data are checked by the Swedish Chemicals Agency; for the agriculture sector, the review is performed by the Swedish Board of Agriculture; for the LULUCF sector, it is conducted by the National Board of Forestry; and for the waste sector, the review is performed by SEPA. The above organizations are defined in Ordinance 2005:626 and the reviews are coordinated by SEPA. In cases where the same organization is also a data provider for the inventory (for example, for the agriculture and waste sectors), a different organization performs the peer review. During such reviews, the methodologies and EFs used are checked, the AD are compared with other national statistics, and areas for further inventory improvements are defined. Document storage and the common workspace for the decentralized inventory preparation process in Sweden are handled by a specific software called the Projectplace tool.[3] In addition, documentation, data and the calculations for each annual submission are also stored on the servers at each organization involved in the preparation of the inventory.

[3] See <www.projectplace.com>.

15. A system for data handling called the Technical Production System (TPS) has been in place since 2007. It allows different users from multiple locations to access and use all data available for the preparation of the inventory, including emission estimates, AD and EFs, while ensuring the security of these data. TPS generates input data for the CRF reporter software using output data functions. The ERT commends Sweden for the implementation of such innovative systems for data handling and storage and for providing an efficient electronic working space for the preparation of the inventory. During the review, the ERT was provided with the requested additional archived information arising from questions to Swedish experts.

4. Follow-up to previous reviews

16. The ERT noted that not all recommendations from the 2011 and 2012 annual review reports have been implemented in the 2013 annual submission. With reference to the 2012 annual review report, the Party stated in paragraph 10.4 of the 2013 NIR that the 2013 annual submission was compiled in mid-October 2012; therefore, the preliminary results of the centralized review for 2012, which took place in September 2012, could only be taken into account through minor recalculations and changes, but not fully addressing most of them. The above statement was confirmed during the review. With regard to the recommendations from the 2011 and 2012 annual review reports that have not yet been addressed by the Party, during the review Sweden provided the ERT with adequate information on the steps taken to address these recommendations and/or data estimates, which showed that the pending recommendations will be implemented and that this information and data will be included in its next annual submission. Therefore, the ERT recommends that Sweden implement all pending recommendations from the 2011 and 2012 annual review reports and include the relevant information in its next annual submission.

17. The following recommendations contained in paragraph 140 of the 2011 annual review report have not yet been implemented in the Party's 2013 annual submission:

(a) Improving the transparency of the information on the nitrogen (N) fractions of different crops (see para. 67 below);

(b) Using country-specific parameters to estimate CH_4 emissions from solid waste disposal on land (see para. 84 below for further information);

(c) Reviewing the estimates of CH_4 emissions from domestic and commercial sludge treated in anaerobic plants (see para. 85 below);

(d) Improving the transparency of the information on the areas for afforestation and reforestation and land converted to forest land; this recommendation is related to a recommendation in the 2012 annual review report (see para. 76 below and table 6);

(e) Improving the consistency and the accuracy of the areas reported under the LULUCF sector (cropland, grassland and settlements converted to forest land) and the areas for afforestation and reforestation, and forest management reported under the KP-LULUCF (see paras. 76, 88 and 89 below).

18. The ERT also noted that the following recommendations from the 2011 annual review report have either been implemented in the Sweden's 2013 annual submission or adequate information on the steps taken to address these recommendations and/or estimates were provided to the ERT by Sweden during the review week, and will be included in Sweden's next annual submission:

(a) Reviewing the estimates for manure management and for pasture, range and paddock manure (see para. 64 below);

(b) Improving the transparency of the information on the carbon stock changes for forest land remaining forest land (see para. 76 below).

19. The ERT also noted that the following recommendations contained in para. 144 of the 2012 annual review report have been implemented in the Party's 2013 annual submission and commends Sweden for its efforts:

(a) Cement production: correcting the reported estimates of the raw meal organic carbon content for cement (see para. 49 below);

(b) Aluminium production: providing an explanation of the increase in PFC emissions from 2009 to 2010 in the NIR;

(c) Consumption of halocarbons and SF_6: continuing efforts to provide estimates of emissions from solvent use, explaining any recalculations and improving the consistency between the NIR and the CRF tables; with regard to the estimation of halocarbon emissions from solvents, Sweden has implemented additional efforts and has concluded that no emissions are occurring (see para 4.7.5 of the 2013 NIR); and the use of the notation keys between the NIR and the CRF tables is consistent in the 2013 annual submission;

(d) Enteric fermentation: including values for the average gross energy intake and average CH_4 conversion rate in the NIR for the entire time series; this recommendation is related to cattle (see para. 64 below);

(e) Manure management: clarifying the definitions used for animal waste management conversion systems, justifying the use of the national conversion factors for liquid manure in the NIR and improving the consistency of the CH_4 implied emission factor (IEF) between the CRF tables and the NIR for swine and reindeer (see para. 65 below);

(f) Improving the calculation method used for forest land remaining forest land using an extrapolation approach based on five-year rolling averages to estimate the annual update of the data. As a result, the carbon stock changes over the time series remain almost constant, and the significant increment for 2009 observed in the 2011 annual submission was averaged out (see para. 76 below);

(g) Providing additional information to illustrate the long-term increasing trend in the carbon stock for forest land remaining forest land reported in the 2012 NIR, as well as the growth rate and the harvest volume during the period 1926–2008. This information enabled the ERT to confirm that the emission/removal trends reported in the 2012 annual submission and the annual harvest volume generally correspond;

(h) Improving the consistency of the notation keys used in the 2011 annual submission between the LULUCF reporting and the KP-LULUCF reporting, by using the correct notation key ("NO" (not occurring)) in CRF table 5(V);

(i) Wastewater handling: including information on the CH_4 emissions trend for 1990–2004 which was provided to the ERT during the 2012 annual review in the NIR and revising the use of the notation keys for the AD reported in the CRF tables where a country-specific method is used (see para. 85 below).

5. Areas for further improvement identified by the expert review team

20. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 8 below.

B. Energy

1. Sector overview

21. The energy sector is the main sector in the GHG inventory of Sweden. In 2011, emissions from the energy sector amounted to 45,014.72 Gg CO_2 eq, or 73.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 16.1 per cent. The key drivers for the fall in emissions are: the increased use of biomass for energy purposes, the reduced fossil fuel consumption in the category other sectors and the reduced energy intensity of the economy over the time series. Within the sector, 44.4 per cent of the emissions were from the transport sector, followed by 23.7 per cent from energy industries, 21.1 per cent from manufacturing industries and construction, 8.1 per cent from other sectors, and 2.2 per cent from fugitive emissions from fuels. The remaining 0.4 per cent were from other. The methodologies, AD and EFs used by Sweden correspond generally to higher-tier methods of high quality.

22. Sweden has made recalculations for the energy sector between the 2012 and 2013 annual submissions following changes in AD (e.g. inclusion of combustion of coke for heat production used in carbide manufacturing (in CRF table 1.A.2(c)); revisions of the annual energy balances for stationary combustion impacting all fuels used in the other sectors (e.g. in CRF table 1.A.4 and parts of CRF table 1.A.2(f)) for the years 2009–2010; and adjustment of the ratio for aviation gasoline for civil aviation following the underestimation identified in the 2012 annual submission) and EFs (e.g. correction of minor errors in the CO_2 EF for natural gas for the period 2007–2010); and in order to respond to recommendations from previous review reports. The recalculations for two categories (CO_2 emissions from combustion of residual fuel oil used in navigation for 2009 and 2010, and CO_2 emissions from other sectors for liquid fuels for 2009 and 2010) mainly accounted for the resulting downward revision (see table 9 in annex I to this report).

23. In response to questions raised by the ERT during the review week, Sweden informed the ERT that the residual fuel oil sales data for the navigation category were not provided by one oil company for the years 2009 and 2010, while all other companies provided the required data. Efforts by the Swedish authorities to obtain the necessary information from that oil company proved to be unsuccessful over the last year. Sweden therefore linearly interpolated the entire national residual fuel oil consumption between 2008 and 2011 for the recalculated estimates for this category. The ERT pointed out that since actual consumption data were available for all the other companies, except one, the interpolation should be performed for this one company only and not for the entire national consumption. Actual sales data should be used for all the other oil companies. Sweden agreed to this suggested change in methodology and accordingly, during the review week, submitted revised inventory estimates for CO_2, CH_4 and N_2O emissions for 2009 and 2010 from the use of residual fuel oil in navigation (0.6 and 0.3 per cent increase, respectively). The ERT agreed with the revised estimates.

24. Other recalculations, such as those for CO_2, CH_4 and N_2O emissions from the subcategories other under manufacturing industries and construction, and commercial/institutional, residential and agriculture/forestry/fisheries under other sectors, are performed routinely each year since the fuel consumption for the latest emission year for other sectors is a preliminary estimate which is updated by preliminary annual energy balances the following year and by final annual energy balances two years thereafter. An analysis of previous four-year recalculations has shown that the energy balance data is generally revised downwards.

25. The inventory of Sweden is complete in terms of years, categories, gases and geographical coverage. The ERT noted that the notation key "NE" (not estimated) has been used to report fugitive CO_2 emissions from oil loaded in tanker ships due to the current

unavailability of data. The ERT encourages Sweden to estimate these emissions. The notation key "IE" (included elsewhere) has been used to report CO_2 and CH_4 emissions from the subcategories oil, gas and combined in venting. Sweden explained that these emissions probably do not occur, but, if they do occur, Sweden has reported them mainly under the subcategories refining/storage in the category oil and partly under oil flaring. Sweden also explained that since these possible emissions are very small and the efforts required to separate them would not be justified on a resource and time basis. Sweden has also used the notation key "IE" to report CO_2, CH_4 and N_2O emissions from gas flaring, which are reported under oil flaring since the amount of gaseous fuels flared is negligible and it is not possible to separate them from liquid fuels. The ERT agreed with Sweden's explanation.

26. The times-series consistency of the inventory for the energy sector is good. Where possible, the AD, EFs and methodologies are used consistently over the time series. If not, an explanation is provided in the NIR and extrapolations or interpolations are conducted in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance).

27. The ERT identified a major issue of transparency related to the lack of clarity in the NIR on how the energy sector AD for various categories were selected from alternative databases. Sweden uses five AD sources for stationary combustion; that is, Quarterly Fuel Statistics (KvBR), Energy Use in Manufacturing Industry (ISEN), the European Union emissions trading system (EU ETS), environmental reports from companies and energy balances. The coverage and quality of each data source is described in the NIR (annex 2). For instance, for the iron and steel subcategory, alternative data are available from the energy balance, the EU ETS and company environmental reports. The ERT noted that the Party has not transparently reported in the NIR how the various databases represent the energy consumption in a particular category, whether relevant data sets match or show large differences and, if so, whether Sweden takes steps to reconcile these differences before choosing the most appropriate data set for that particular category for the national GHG inventory estimates. Also, no transparent information is reported if reconciliation is not required.

28. The ERT therefore recommends that Sweden appropriately explain in the NIR of its next annual submission the reasons for the use of a particular database for the various inventory categories and, if various data sets are used, how these data sets are reconciled. The Party should also explain why a specific database is chosen to estimate the national GHG inventory emissions for a particular category.

29. The QA/QC procedures used for the inventory estimates for the energy sector are satisfactory. Sweden also performs an internal evaluation (as part of its QA procedures) of the inventory before submitting it to the UNFCCC. In response to questions raised by the ERT during the review on QA/QC procedures, Sweden was easily able to provide the ERT with further clarification, for example on the trends or the specific allocation of emissions which seemed (among other things) to be available because of the documentation on the QA/QC procedures. The ERT was satisfied with the information provided by the Party on the QA/QC procedures. The ERT was provided with access to confidential information at the Regions and Environment Department of Statistics Sweden upon request, duly following signature of a confidentiality clause that further reinforced the ERT's satisfaction with the Party's QA/QC procedures.

2. Reference and sectoral approaches

30. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 31–33 below.

Table 5
Review of reference and sectoral approaches

		Paragraph cross-references
Difference between the reference approach and the sectoral approach in 2011	Energy consumption: 28.29 PJ, 4.71% CO_2 emissions: 623.70 Gg CO_2 eq, 1.48%	
Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables?	No	31–32
Are differences with international statistics adequately explained?	No	33
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

Comparison of the reference approach with the sectoral approach and international statistics

31. For 2011, there is an overall difference of 1.48 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach (2.53 per cent for liquid fuels and –1.94 per cent for solid fuels). Fluctuating differences are also observed for other years of the time series and are explained by the differences in the data from the energy balances used for estimating the CO_2 emissions in the reference approach and the data used for estimating the CO_2 emissions in the sectoral approach. The differences in energy consumption are generally higher for solid fuels (ranging between 15 per cent and 35 per cent over the time series, with the estimates for the reference approach being higher). During the review, Sweden explained that the differences between the reference approach and the sectoral approach are reduced if the energy losses in coke oven and blast furnaces are accounted for in the reference approach. For liquid fuels, the differences are much lower (up to 5 per cent). However, the differences for solid and liquid fuel consumption are generally in different directions (for solid fuels, the reference approach estimates are higher than the sectoral approach estimates, but for liquid fuels, the reference approach estimates are lower than the sectoral approach estimates). These differences that have continued over the course of more than five annual submissions indicate a systematic deficiency, where

greater efforts are needed by Sweden to resolve the differences, in particular regarding the accuracy of the sources of data, such as the energy balance, for future annual submissions.

32. The ERT therefore strongly recommends that Sweden minimize the differences in the energy balance between the reference and sectoral approaches in future annual submissions so as to reduce the differences in the emission estimates between the two approaches, in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines).

33. The apparent consumption according to Sweden's reference approach for 2011 does not correspond closely to the International Energy Agency (IEA) data (there is a difference of 8.0 per cent), mainly due to the reporting of non-renewable and municipal waste production only to IEA and the differences in the gas/diesel oil stock change. For other years of the time series, the apparent consumption reported to the UNFCCC corresponds to that reported to IEA within 5.0 per cent, except for 2002 (6.0 per cent) and 2010 (7.0 per cent). The 1990–2011 growth rate of the total apparent consumption is 11.0 per cent in the CRF tables, while it is –1.0 per cent according to the IEA data. During the review, Sweden explained that in 2013 a detailed study of the differences between the CRF data and the data from the Statistical Office of the European Union (Eurostat) (which, with minor exceptions, are identical to the IEA data) was conducted.[4] The major conclusions were that the differences are generally caused by differences in the calorific values used and that, for liquid fuels, large differences sometimes occur in the stock change data which lead to differences in the apparent consumption. The ERT encourages Sweden to make efforts to resolve these differences to the extent possible for its next annual submission.

International bunker fuels

34. The fuel used for aviation and marine bunkers in Sweden is substantially greater than the fuel used for navigation and civil aviation; for example, 31,801.82 TJ jet kerosene consumption for international aviation compared with 7,235.15 TJ for domestic aviation, and 67,240.06 TJ residual fuel oil consumption for international navigation compared with 3,226.40 TJ for domestic navigation. These figures underline the importance of performing accurate estimates for international bunker fuels. International marine freight transport activity has gradually increased over the years since the Swedish refineries began producing low-sulphur residual fuel oil, which fulfils strict environmental requirements; this has led to more shipping lines choosing to refuel in Sweden. The inter-annual fluctuations in the volume of bunkered fuels also vary according to the price of fuel in Sweden in comparison with the ports in other countries. The allocation of fuels to bunkers is in accordance with IPCC good practice guidance.

35. Sweden uses a national model to estimate CH_4 and N_2O emissions from aviation bunker fuels. This is in accordance with the IPCC good practice guidance. The CO_2 emissions are based on the total fuel consumed in international flights. For the emissions from marine bunkers, the AD collection methodology is very accurate and is based on fuel sales to the ships.

Feedstocks and non-energy use of fuels

36. The ERT did not identify any problems regarding the reporting of feedstocks and non-energy use of fuels, except for the non-energy use of solid and liquid fuels in the iron and steel industry (see paras. 39–40 below).

[4] SMED Report No. 125, 2013: *Differences between Eurostat and CRF Data in Swedish Reporting*.

3. Key categories

Stationary combustion: liquid, solid and gaseous fuels – CO_2

37. The ERT noted that although Sweden splits the energy and industrial processes emissions from iron and steel activities between three categories in the energy sector (public electricity and heat production, manufacture of solid fuels and other energy industries, and iron and steel) and one category in the industrial processes sector (iron and steel production) the reporting is not transparent. The ERT considered that it was not possible to ascertain from the information provided in the NIR and the CRF tables where and how the energy consumption and feedstocks, and CO_2 emissions from iron and steel industry are accounted for under the various categories.

38. To have a better understanding of this issue, the ERT requested that Sweden, during the review, provide a carbon mass balance for integrated steel plants in the iron and steel industry to show all the carbon input and output flows including the carbon in all intermediate products (e.g. coke oven gas, blast furnace gas, etc.), and the carbon in the finished products and in the CO_2 emissions. The ERT also requested that the Party transparently indicate where these emissions are reported in the CRF tables and in the NIR. Similarly, the ERT requested that Sweden provide an energy balance for the iron and steel industry. These detailed balances were provided by Sweden during the review, which helped to clarify the reporting of emissions and energy consumption and enhanced transparency. The ERT therefore strongly recommends that Sweden provide detailed energy and carbon mass balances for the iron and steel industry in the NIR of its next annual submission, and also make this a regular feature in the NIR of its future annual submissions.

39. The ERT noted that the CO_2 IEFs for liquid fuels for 2010 (68.83 t/TJ) and 2011 (68.33 t/TJ) for the commercial/institutional category are some of the lowest among the reporting Parties (ranging from 62.44 t/TJ to 95.57 t/TJ). In addition, the inter-annual changes in these CO_2 IEFs for 2004–2011 (ranging from –1.6 per cent to 1.1 per cent) are significant. Also, the ERT noted that the CO_2 IEF value for 2011 is 8.1 per cent lower than the 1990 value (74.36 t/TJ) and that the trend of these CO_2 IEFs is unstable and fluctuates during the latter years of the time series.

40. Sweden explained that the use of liquid fuels in the commercial/institutional category has decreased considerably since the 1990s because biomass fuels have replaced heating oils to a large extent. The use of propane/butane, however, has increased in recent years. The CO_2 EF for propane/butane is 65.10 t/TJ and the CO_2 EFs for domestic heating oil and residual fuel oil are 74.26 t/TJ and 76.20 t/TJ, respectively. Hence, the high share (around 50 per cent) of propane/butane in recent years has resulted in low aggregate IEFs for liquid fuels. The ERT agreed with the explanation provided by Sweden. The ERT recommends that Sweden include this information and explanations in its next annual submission.

Road transportation: liquid, gaseous and biomass fuels – CO_2, CH_4 and N_2O[5]

41. CO_2 emissions from road transportation is the single largest key category for Sweden (excluding the LULUCF categories). The CO_2 emission estimates are calculated using a combination of a tier 1 approach with country-specific EFs and the CH_4 and N_2O emissions are estimated using a model-based approach. Sweden has a database for this category, which includes data on, for example, the vehicle fleet, the composition of the fuel

[5] Not all emissions related to all gases and fuels under this category are key categories, particularly N_2O emissions. However, since the calculation procedures for the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

and the current traffic profile, supported by the road traffic emissions model HBEFA 3.1 to account for these emissions. The fuel consumption estimates calculated using these two independent approaches correspond closely, thereby indicating the robustness of the emission estimates. The methodology and assumptions used in the HBEFA 3.1 model are in accordance with the IPCC good practice guidance.

42. Biofuel blending in gasoline and diesel oil has been increasing steadily over the years in Sweden, amounting to about 400,000 m^3 ethanol and 300,000 m^3 fatty-acid methyl ester (FAME) biodiesel in 2011. This has contributed to a reduction in fossil fuel based CO_2 emissions in Sweden. CO_2 emissions from biogenic origin are separated and not accounted in the estimates of sectoral total. The ERT noted that the inter-annual changes in the CH_4 IEFs for gasoline for 2000–2001 (–10.0 per cent) and 2001–2002 (–10.6 per cent) are significant. The 2011 CH_4 IEF value (12.86 kg/TJ) is 73.3 per cent lower than the 1990 value (48.09 kg/TJ). Sweden explained in the NIR that it uses country-specific EFs to estimate the CH_4 emissions from road traffic which take into account parameters other than fuel type. During the review, the ERT had the opportunity to discuss Sweden's road transportation model with concerned sectoral expert, understand the various parameters other than fuel types such as vehicle fleets, age, emission profile; data for these parameters and simulation of actual driving cycles for various vehicle types. The ERT is convinced that the fluctuations represent actual occurrences. Similar conclusions were arrived for noted inter-annual fluctuations in N_2O IEFs for gasoline.

4. Non-key categories

Oil and natural gas: gaseous fuels – CO_2

43. The ERT noted that CO_2 emissions from distribution (natural gas) have been reported as not applicable ("NA") for all years of the time series. Sweden indicated that the emissions reported in this category will be reported in the 2014 annual submission due to methodological improvements. The ERT encourages Sweden to do so.

C. Industrial processes and solvent and other product use

1. Sector overview

44. In 2011, emissions from the industrial processes sector amounted to 6,660.58 Gg CO_2 eq, or 10.8 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 288.93 Gg CO_2 eq, or 0.5 per cent of total GHG emissions. Since 1990, emissions have increased by 5.2 per cent and by 3.4 per cent since the base year, in the industrial processes sector (a 75.5 per cent increase since the base year for fluorinated gases), and decreased by 13.1 per cent in the solvent and other product use sector. The key drivers for the rise in emissions in the industrial processes sector are the increase in HFC emissions from consumption of halocarbons and SF_6 due to ozone-depleting substances being replaced by HFCs as refrigerants, and the increase in CO_2 emissions from mineral products, due to the steady increase in the production of clinker and lime, and in the limestone and dolomite use. The significant increase in HFC emissions (by 19,485.67 per cent) during the period 1990–2011 is balanced by the decreasing trend in emissions from chemical industry (by 80.1 per cent). In 2011, the emissions from nitric acid production fell by 86.8 per cent compared to 2010 levels, due to the rise in the use of N_2O-reducing catalysts in the plants (see para. 50 below). Within the industrial processes sector, 51.9 per cent of the emissions were from metal production, followed by 31.1 per cent from mineral products, 12.8 per cent from consumption of halocarbons and SF_6, and 2.9 per cent from chemical industry. The remaining 1.3 per cent were from other production. There were no emissions from production of halocarbons and SF_6 (reported as "NO" and "NA"). The data sources for the industrial processes sector are mainly a

combination of EU ETS data, company environmental reports, direct information from facilities/plants in the mineral products, chemical industry and metal production categories, and national statistics and data from the Product Register maintained by the Swedish Chemicals Agency for the category consumption of halocarbons and SF_6.

45. The inventory for this sector is generally complete, with some categories reported as "NE" where no IPCC methodology is available (e.g. CH_4 emissions from aluminium production). The inventory is generally transparent, but sometimes lacks sufficient detail when referring to the specific data sources used when these are combined to calculate an emissions estimate (for example for cement production and iron and steel production). The ERT recommends that Sweden elaborate, in the NIR of its next annual submission, on which data are derived from which source (e.g. the AD are from a company environmental report, etc.), and on the methodology used when the emissions are directly derived from company environmental reports, especially for the key categories. The ERT also recommends that Sweden further enhance transparency through the provision of background information on some categories in the NIR, especially when large emission reductions occur or when gases are collected/destructed.

46. The ERT noted that general QA procedures are conducted at various levels by SMED and SEPA, as well as through the national peer reviews, and general QC procedures are conducted at the level of the various data providers and at various levels by SMED and SEPA. The ERT also noted that a major part of the QC process relies on the procedures conducted at the level of the data provider, the content of which is not documented in the NIR. Taking note of the second paragraph on page 8.9 of the IPCC good practice guidance, the ERT encourages Sweden to confirm the QC procedures performed by the various data providers and document them in the NIR of its next annual submission, especially for the key categories.

47. Sweden has made recalculations for the industrial processes and the solvent and other product use sectors between the 2012 and 2013 annual submissions, mainly due to the exclusion of previously double-counted emissions from organic carbon in the raw material used in cement production for the years 2005–2010, where the double counting originated in the introduction of EU ETS data (see table 9 in annex I to this report). The ERT commends Sweden for this improvement to the accuracy of the inventory, and encourages it to continue in its efforts to refine the inventory, especially for the years following the introduction of EU ETS data.

2. Key categories

Cement production – CO_2

48. Sweden applied a tier 2 method using clinker production and the calcium oxide (CaO) content of the clinker for the emission estimates for this category. The CO_2 emission estimates have been corrected for cement kiln dust and bypass dust, and emissions from the organic carbon content of the raw meal have been included. This is in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The emissions reported cover the three cement-producing facilities in Sweden.

49. The ERT observed inter-annual fluctuations in the CO_2 IEF for this category following the introduction of EU ETS data for the years 2005–2011 (ranging from –3.1 per cent to 3.6 per cent); however, the NIR lacks information on the composition of the raw material and on the bypass and cement kiln dust that would contribute to explaining this fluctuation. During the review, the ERT requested that Sweden provide information on the composition of the raw material across the time series, if available, but Sweden could not obtain the required information from the producing company. The ERT recommends that Sweden include information on the composition of the raw material and on the bypass and

cement kiln dust in the NIR of its next annual submission, especially for the years after which the EU ETS data were introduced, to increase transparency, and to ensure the QC of the facility data currently obtained from company environmental reports, EU ETS data and direct contacts with the facilities.

Nitric acid production – N_2O

50. The ERT noted a decrease of 80.1 per cent (776.1 Gg CO_2 eq) from 1990 to 2011 in the chemical industry category, the major driver of which is a 95.0 per cent decrease (772.7 Gg CO_2 eq) in N_2O emissions from nitric acid production. The large inter-annual change in the N_2O IEFs for 2010–2011 (–87.2 per cent) is due to the fact that the N_2O-reducing catalysts in the two production plants of the sole facility currently producing nitric acid in Sweden were used for the whole year in 2011, whereas they were only partly used for the year 2010.

51. According to the information provided by Sweden during the review, nitric acid is currently produced in atmospheric pressure and medium/high pressure plants. The emission estimates are based on a tier 3 method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), using direct measurement data. The technology applied for abatement is a combination of precious-metal primary catalysts and secondary catalysts, with the N_2O emission levels monitored by an automated monitoring system that follows the guidance of the European Norm EN14181 (2004).[6] The ERT recommends that Sweden elaborate on the above information in the NIR of its next annual submission, to the extent possible, while taking into account confidentiality restrictions, in order to more transparently explain the strong decreasing trends in the N_2O emissions and EFs.

Iron and steel production – CO_2

52. Sweden estimated the emissions from iron and steel production under the industrial processes sector using a tier 2 method from the IPCC good practice guidance, mainly based on data from company environmental reports. During the review, the ERT identified a lack of transparency with regard to the way in which the emissions were split between the energy and industrial processes sectors, and how they were allocated among the subcategories public electricity and heat production, manufacturing of solid fuels and other energy industries, and iron and steel in the energy sector, and iron and steel production in the industrial processes sector (see paras. 39 and 40 above).

53. During the review, the ERT requested that Sweden provide a carbon mass balance for the two integrated iron and steel production plants in the country to illustrate all carbon input and output flows, including the carbon in intermediate products (e.g. coke oven gas, blast furnace gas, etc.) and finished products, and the CO_2 emissions. The above-mentioned information was provided by Sweden, which helped to clarify the reporting of emissions under the various subcategories mentioned in paragraph 52 above. Based on the information provided by the Party, the ERT noted that the emissions have been correctly reported without any omissions.

54. The ERT strongly recommends that Sweden provide detailed energy and carbon mass balances for the two integrated iron and steel production plants and corresponding explanations in the NIR of its next annual submission, with a clear indication of where in the CRF tables the associated emissions are reported.

[6] "Stationary source emissions – quality assurance of automated measuring systems".

Consumption of halocarbons and SF_6 – HFCs, PFCs, SF_6[7]

55. The ERT noted an increase of 152.3 per cent in total emissions from consumption of halocarbons and SF_6 between 1995 and 2011, with an increase of 394.1 per cent for HFCs from refrigeration and air-conditioning equipment due to the replacement of refrigerants with ozone-depleting substances by HFCs. A national model, which corresponds to the IPCC tier 2 approach estimation methodology, has been used to estimate actual emissions for all subcategories. Potential emissions have been reported based on bulk import and export data for the whole consumption of halocarbons and SF_6 category.

56. The ERT noted a lack of clarity about whether collection/destruction is accounted for in the model. Assumptions have been made when estimating the emissions, for example for emissions from disposal of windows utilizing SF_6 as insulating material, where all SF_6 is assumed to be emitted during its lifetime before disposal, which in turn does not entail any collection/destruction. In response to a question raised by the ERT during the review, Sweden provided information on EC Regulation No. 842/2006 of 17 May 2006 on certain fluorinated greenhouse gases, which addresses the containment, use, recovery and destruction (Article 4) and reporting (Article 6) of such gases. The ERT noted that with this regulation in place, information may be readily available to incorporate into the model for use in the estimation of GHGs and thereby enhance the accuracy of the inventory, or for the QC of the outputs from the model. The ERT recommends that Sweden further investigate the application of this regulation and its coverage, and confirm availability of data that may be available for use in the inventory, and that the Party incorporate these findings in the NIR of its next annual submission. The ERT also encourages Sweden to incorporate available data on collection/destruction into the model for the next annual submission.

57. The ERT commends Sweden for the clarity with which it described the model used in annex 3.1 to the NIR, and noted that there are several subcategories for which lower annual leakage rates are assigned for newer equipment, compared to older equipment. In response to a question raised by the ERT during the review, Sweden provided information explaining that mobile air conditioners (excluding buses), commercial refrigeration (heat pumps and transport refrigeration), and electrical equipment have lower annual leakage rates for newer equipment. The ERT recommends that Sweden provide and clearly describe, in the NIR of its next annual submission, information similar to that described above, where groups of equipment are treated differently by age class or size, etc., and are assigned different EFs, in order to increase the transparency of the model used.

58. The ERT also noted that the notation key "NA" has been used in a number of cases where F-gas emissions from an activity probably occur, but no emissions occur at a certain point in time, such as electrical equipment, where emissions from disposal currently do not occur, in which case they should be reported as "NO". The ERT recommends that Sweden reassess its use of the notation key "NA" and modify, where necessary, the notation keys used to report all emissions from this category in its next annual submission.

3. Non-key categories

Limestone and dolomite use – CO_2

59. The ERT noted that Sweden has continued to choose not to report CO_2 emissions from the use of limestone and dolomite in primary and secondary production of steel, other metal production, production of clay-based products and glass production under this

[7] Not all emissions related to all gases under this category are key categories, except for HFC emissions from refrigeration and air-conditioning equipment. However, since the calculation procedures for the issues related to this category are discussed as a whole, the individual gases are not assessed in separate sections.

category. Sweden has recognized in the NIR the recommendations made in the previous review reports that the current reporting is not in line with the Revised 1996 IPCC Guidelines. However, Sweden reiterated that CO_2 emissions from these sources are small and that it is not considered to be good practice to spend resources on obtaining the underlying data in order to separate these emissions.

60. The ERT recommends that Sweden report these emissions under the category limestone and dolomite use or, if it chooses to continue reporting under the various other subcategories, that Sweden clarify and explain, in its next annual submission, how the company environmental reports and EU ETS reporting are set up, how this creates difficulty for the separate reporting of emissions, but how the completeness of the reporting is still ensured.

D. Agriculture

1. Sector overview

61. In 2011, emissions from the agriculture sector amounted to 7,770.64 Gg CO_2 eq, or 12.6 per cent of total GHG emissions. Since 1990, emissions have decreased by 13.6 per cent. The key drivers for the fall in emissions are the decreases in the number of livestock and the decrease in the application of N fertilizer. In 2011, 57.2 per cent of the emissions were from agricultural soils, followed by 33.2 per cent from enteric fermentation and 9.6 per cent from manure management. Rice cultivation, prescribed burning of savannas and field burning of agricultural residues were reported as "NO" as these activities do not occur in Sweden.

62. Sweden has made recalculations for the agriculture sector between the 2012 and 2013 annual submissions for the whole time series in response to comments received from the EU review under the Effort Sharing Decision (the EU has binding annual targets for the period 2013–2020 for reducing GHG emissions from housing, agriculture, waste and transport, excluding aviation, based on emission levels in 2005 and 2008–2010). The largest changes in the most recent years have addressed enteric fermentation for calves feeding only on milk, an error related to the manure production rate for grazing beef cattle, and the total area of agricultural land for all years of the time series due to the improvement of the method used by the Swedish University of Agricultural Sciences for calculating cropland areas. In addition, the data for sludge spreading in agricultural soils have been updated for 2010 (see table 9 in annex I to this report).

63. During the review week, in response to questions raised by the ERT, Sweden provided revised estimates of N_2O emissions from N-fixing crops and crop residues using actual crop yield data instead of estimated standard values of crop yields for the years 2008–2011. The revised estimates led to a decrease of 0.02 per cent in total sectoral emissions (1.49 Gg CO_2 eq) for 2011, a decrease of 0.04 per cent (3.12 Gg CO_2 eq) for 2010, an increase of 0.29 per cent (22.47 Gg CO_2 eq) for 2009 and a decrease of 0.02 per cent (1.24 Gg CO_2 eq) for 2008.

64. The inventory of the agriculture sector is complete in terms of categories, gases, geographical coverage and years. The reporting of the sector is generally transparent. However, the ERT noted that the recommendations made in the previous review report regarding the improvement of the transparency of the NIR by including further background information on the calculation of the average milk yield, the N flow model (STANK) and the CH_4 IEF trends for manure management have not been addressed in the 2013 annual submission. In response to a question raised by the ERT during the review, Sweden provided the ERT with a summary of the STANK model indicating how to use the model, rather than the equations used, and a rationale of the assumptions used for the calculations

of the model. The ERT recommends that Sweden implement those pending recommendations in order to increase the transparency of its reporting in its 2014 annual submission, in particular regarding the STANK model. The ERT noted that uncertainty values (whether country-specific or IPCC defaults) used by Sweden in its uncertainty analysis for the agriculture sector are well documented for each subcategory in the NIR.

65. Most of the recommendations made in the previous review reports (e.g. explaining the definitions used for animal waste management systems; justifying the use of the national methane conversion factor for liquid manure; improving the consistency of the CH_4 IEF used for swine and reindeer between the CRF tables and the NIR for the entire time series; improving the consistency of the information on N excretion for pasture, range and paddock between CRF tables 4.B(b) and 4.D) have been addressed in the 2013 annual submission. The ERT commends Sweden for implementing the above-mentioned recommendations.

2. Key categories

Manure management– CH_4

66. The ERT noted that the inter-annual changes in the CH_4 IEFs for 1998–1999 (5.7 per cent), 2000–2001 (30.2 per cent), 2002–2003 (10.3 per cent), 2004–2005 (10.4 per cent) and 2006–2007 (5.7 per cent) for non-dairy cattle have been identified as significant. The CH_4 IEF for 2011 (6.08 kg/head/year) is 95.7 per cent higher than the 1990 value (3.11 kg/head/year). All the values for 1990–2010 (3.11–5.99 kg/head/year) with the exception of 2008 are lower than the IPCC default value (6 kg/head/year). In response to a question raised by the ERT during the review, Sweden mentioned that "the reason for the continuous increase in the IEFs is a shift in the manure management methods: the use of deep litter storage has become more common and the use of solid storage less common for meat cows. This leads to an increase in the IEF for CH_4 due to the higher EF for deep litter. The reasons for the fluctuations are that the underlying data fluctuate. The calculations are built on the biannual survey on the use of fertilizers and animal manure in agriculture. Small fluctuations in the fraction of manure stored as deep litter have large effects on the emission estimates due to the large difference in EF between deep litter and solid/liquid manure management systems". Sweden also stated that "these fluctuations can reflect actual changes but can also arise due to sampling errors". The ERT notes that the explanations provided include some uncertainties regarding the underlining drivers of the fluctuations; however, it is not possible to repeat the sampling or analysis for historical years. The ERT recommends that Sweden include the information provided to the ERT during the review regarding the values of the CH_4 IEFs for non-dairy cattle and the reason for their fluctuations in its next annual submission.

Agricultural soils – N_2O

67. The ERT noted that standard crop yields were used instead of actual crop yields for estimating the N_2O emissions from N-fixing crops and crop residues (pp. 256 and 257 of the NIR). In response to a question raised by the ERT during the review week regarding the reason for the use of estimated data instead of actual data, Sweden explained that the reason is that the time series becomes more stable and not drastically affected by stochastic events such as extreme weather conditions. The standard crop yields are calculated by Statistics Sweden with a regression model that uses actual crop yields from the last 15 years as input. The ERT considered that the method used by the Party may lead to an under or overestimation of emissions if the calculated standard yield for a given year is lower or higher than the actual yield. During the review week, Sweden submitted revised N_2O emission estimates for N-fixing crops and crop residue using actual crop yields for the years 2008–2011. The ERT considers that the revised N_2O estimates resolved the issue. Nevertheless, the ERT recommends that Sweden revise the estimates of N_2O emissions for

these two subcategories for the complete time series using actual crop yields in its next annual submission, and include relevant information in the NIR.

68. The ERT noted that the N_2O IEFs for 1990–2011 (0.025 kg N_2O-N/kg N) reported for animal manure applied to soils are constant and are the highest among the reporting Parties (ranging from 0.0040 kg N_2O-N/kg N to 0.025 kg N_2O-N/kg N) and above the IPCC default range (ranging from 0.0025 kg N_2O-N/kg N to 0.0225 kg N_2O-N/kg N). In response to a question raised by the ERT during the review regarding this value, Sweden indicated that it uses a country-specific EF developed at the University of Gothenburg.[8] The ERT recommends that Sweden include detailed information on the country-specific EF used for animal manure applied to soils in its next annual submission.

E. Land use, land-use change and forestry

1. Sector overview

69. In 2011, net removals from the LULUCF sector amounted to 35,231.66 Gg CO_2 eq. Since 1990, net removals have decreased by 5.3 per cent. The key drivers for the fall in removals are, first, the increase in harvest rates, while the increase in gross removals derived from tree growth has not been equally large, resulting in a decrease in net removals over the most recent years of the time series and, secondly, the effect of two severe storms in 2005 and 2007, which brought down a large quantity of wood, increasing the estimate of gross felling (including felled by storms and normally harvested) to about 122 Mm^3, while over the period 1990–2010, the gross felling ranged between 64 Mm^3 and 96 Mm^3. Within the sector, net removals of 39,255.61 Gg CO_2 eq were from forest land, followed by net emissions of 2,650.73 Gg CO_2 eq from settlements and 1,318.13 Gg CO_2 eq from cropland. Wetlands accounted for net emissions of 53.79 Gg CO_2 eq and grassland accounted for 1.29 Gg CO_2 eq. The reporting of the LULUCF sector is generally complete; all land areas (except high mountains, military impediments and urban land) and all carbon pools and other sources have been reported for the land-use categories that are considered managed, in line with the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

70. The ERT noted that Sweden has reported in its NIR (p. 271) that in 2011 the net removals from the LULUCF sector were estimated as 35,217 Gg CO_2 eq, but in CRF table summary 2 the estimate of net removals is reported as 35,231.66 Gg CO_2 eq. The ERT recommends that Sweden improve its QC procedures and report the correct estimate in a consistent manner in the NIR and in the CRF tables in its next annual submission.

71. Sweden has made recalculations for the LULUCF sector between the 2012 and 2013 annual submissions following the improved estimates of the area variability due to the applied methodology using random sampling, but also due to the availability of new data derived from the updated Swedish National Forest Inventory (NFI), owing to the revision of the sample data used for the calculation of the carbon stock changes in living biomass, dead organic matter (DOM) and soil organic carbon (SOC) in mineral soils, including updated sampling data from the Swedish Forest Soil Inventory, and in order to correct identified errors, such as minor corrections of historical land-use changes (see table 9 in annex I to this report).

72. The ERT noted that the information on recalculations in the NIR (section 7.6) has not been provided at the category-specific level. This observation was included in the 2012 annual review report. The ERT reiterates the recommendation from the previous review

[8] Klemedtsson, 2001.

report that Sweden include detailed information on the rationale for and the impact of the recalculations at the category- and pool-specific level in its next annual submission.

73. Sweden has reported that the carbon stock changes in the living biomass pool for all land-use categories have been recalculated for the years 2007–2011 to improve accuracy (p. 301 of the NIR). However, the ERT noted that the estimated uncertainty of the CO_2 removals in the living biomass pool reported in the NIR (table 7-5) is 30 per cent, which is higher than the uncertainty reported in the previous annual submission (24 per cent). In addition, the reported uncertainties associated with DOM and SOC have remained constant in the 2012 and 2013 annual submissions (50 per cent and 35 per cent, respectively), even though recalculations have been performed in the 2013 annual submission. The ERT considers that the recalculations have not improved the uncertainty estimates and raised a question during the review regarding the provision of detailed information on the rationale for the recalculations and their impact on the uncertainty estimates.

74. In response to the question raised by the ERT during the review regarding the provision of detailed information on the recalculations, Sweden provided the ERT with additional information describing the recalculations by category/subcategory/gas, focusing on the new AD used in the recalculated estimates (e.g. plot data from the National Forest Inventory (NFI) or the Swedish Soil Inventory). Furthermore, Sweden, in its comments to the draft review report, provided additional information clarifying that the methodology used to estimate uncertainty considers that the accuracy is quite stable in absolute terms but that it decreases or increases if the net removals change. Therefore, the uncertainty in relative terms is not suitable for applying to LULUCF estimates, since the net removal values could be zero, resulting in a huge relative uncertainty, also for cases with a very accurate inventory estimates. For the same reasons, the uncertainties of DOM and SOC are based on expert judgement, since the emission/removals sometimes lie very close to zero. The ERT found this information sufficient and recommends that Sweden provide these explanations on the impacts of the recalculations and how they affect the uncertainty estimates in its next annual submission.

2. Key categories

Forest land – CO_2

75. A country-specific methodology and AD have been used for the CO_2 estimates for forest land, in line with the tier 2 and tier 3 methods contained in the IPCC good practice guidance for LULUCF using different approaches depending on the pool estimated. Sweden has used detailed calculations by strata (31 counties) for the carbon stock changes in the living biomass, DOM and SOC pools, but has reported emissions and removals using aggregated values only at the national level. The ERT considers that reporting disaggregated information may contribute to the improvement of transparency and may facilitate the assessment of the inventory. The ERT recommends that Sweden provide, in the NIR of its next annual submission, information on the use of stratification for estimating carbon stock changes based on random sampling, including a description of the procedure for summing estimates over strata up to the national scale and how it improves the estimates.

76. The ERT noted that Sweden has implemented the recommendation from the 2012 annual review report regarding the inclusion of additional information explaining the trends and the way in which the areas for the five land-use categories of conversions to forest land are estimated, using a new approach (extrapolation based on five-year rolling averages), while ensuring consistency with the areas reported under forest land remaining forest land. In response to a question raised by the ERT during the review, Sweden provided a document to the ERT with additional information explaining how the extrapolation (based on five-year rolling averages) is applied to living biomass and to the areas for which

insufficient data have been obtained from the NFI cycles for each category of land converted to forest land. Additionally, Sweden explained that the high inter-annual variations in land converted to forest land are caused by the 20-year transition period used, which means that land areas are both added to and subtracted from the total land area of the category. The ERT noted these explanations and recommends that Sweden include this information in its next annual submission.

Cropland – CO_2

77. The ERT noted that the CO2 emissions/removals for this category are estimated using country-specific methodologies with a tier 3 approach for the living biomass, DOM and SOC pools. The ERT noted fluctuations in the trend of net CO_2 emissions for this category, which is mainly driven by the emissions from organic soils in cropland remaining cropland. The carbon stock changes in organic soils are estimated using a tier 2 approach with country-specific EFs. The overall decrease in the emissions trend is explained by the decrease in the total area of cropland. In the previous review report it was recommended that Sweden provide information on the drivers of the inter-annual fluctuations in CO_2 emissions from cropland remaining cropland; however, the ERT noted that there is no additional information in the NIR of the 2013 annual submission to explain the drivers of the inter-annual fluctuations in emissions from cropland remaining cropland. The ERT reiterates the recommendation that Sweden provide information on the drivers of the inter-annual fluctuations in CO_2 emissions from cropland remaining cropland in its next annual submission.

Cropland – N_2O

78. Sweden has reported N_2O emissions from disturbance associated with land-use conversion to cropland using a tier 1 methodology and default parameters. The ERT recommends that Sweden make efforts to find locally-specific carbon/nitrogen (C/N) ratios based on measurements of SOC to improve the accuracy of the N_2O emission calculations using a tier 2 method.

3. Non-key categories

Biomass burning – CO_2, CH_4 and N_2O

79. The ERT noted that in the previous review report it was recommended that Sweden ensure the consistent reporting of emissions from biomass burning between the LULUCF sector and the KP-LULUCF activities, as it was noted an inconsistent use of the notation keys between the LULUCF reporting and the KP-LULUCF reporting. For example, in CRF table 5(V), CO_2 emissions from biomass burning on land converted to forest land were reported as "IE", but in CRF table 5(KP-II)5, emissions from biomass burning on afforested and reforested land were reported as "NO". In the 2013 annual submission, Sweden used the notation key "NO" in CRF table 5(V) and in CRF table 5(KP-II)5 in order to maintain the consistency and transparency of the reporting. The ERT recognized this improvement in consistency in the reporting between the LULUCF sector and the KP-LULUCF activities and commends Sweden for addressing this recommendation.

F. Waste

1. Sector overview

80. In 2011, emissions from the waste sector amounted to 1,712.58 Gg CO_2 eq, or 2.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 49.9 per cent. The key drivers for the fall in emissions are the implementation of policies, measures and economic tools towards EU waste management targets which have resulted in the

improvement of waste management practices and techniques in Sweden (e.g. the restriction of organic waste disposal, the recovery of landfill gas for energy purposes and the use of solid waste for district heating). The emission trends are clearly explained and documented in the NIR. Within the sector, 69.6 per cent of the emissions were from solid waste disposal on land, followed by 26.5 per cent from wastewater handling. The remaining 3.8 per cent were from waste incineration.

81. The inventory for the waste sector is generally transparent and complete in terms of years, geographical coverage and gases. However, the ERT noted that biological waste treatment, such as composting and anaerobic treatment, is an emerging practice in the country and encourages Sweden to estimate and report the GHG emissions from these activities in its future annual submissions. Moreover, the ERT noted that the transparency of the description of the waste treatment systems used in the country and the distribution of the waste amounts between different types of treatment is not sufficient. The ERT recommends that Sweden further improve the transparency of the NIR by providing a flow chart for the different waste treatment types and the corresponding AD distribution between them in its next annual submission.

82. The ERT noted that Sweden has a well-developed QC system for checking the GHG inventory results for the waste sector. During the review, Sweden provided the ERT with the documented results of cross-checks and protocols for the waste sector categories from its archiving system. Nevertheless, the ERT identified some weaknesses in the sector-specific QA procedures related to the key categories, for example the lack of collaboration of experts outside the SMED and SEPA in these activities. The ERT encourages Sweden to enhance its QA procedures for the key categories for this sector, for example by involving leading Swedish experts in the areas of solid waste management and wastewater treatment, in discussing the annual national inventory results for the waste sector and documenting the outcomes of these discussions, and include summarized information on actions taken in the NIR of its future annual submissions.

83. The ERT noted that Sweden has made recalculations for the waste sector between the 2012 and 2013 annual submissions due to the availability of new data on landfilled waste for 2010, following changes in the EU waste classification for statistics codes (2006–2010), and due to changes in the allocation of CO_2 emissions from waste incineration to fossil or biogenic origin for the period 2003–2010 (see table 9 in annex I to this report).

2. Key categories

Solid waste disposal on land – CH_4

84. Sweden applied the first order decay (FOD) method with default and some country-specific parameters. The ERT noted that CH_4 emissions from this category have an uncertainty of 56.0 per cent and make a significant contribution (5.9 per cent) to the uncertainty of total GHG emissions in 2011. The ERT also noted that in the 2011 and 2012 annual review reports it was recommended that Sweden conduct studies to obtain country-specific parameters for use in the FOD method to reduce the uncertainty and improve the accuracy of the CH_4 estimates for this key category. This recommendation was not addressed in Sweden's 2013 annual submission. In response to a question raised by the ERT during the review, Sweden explained that this improvement is listed in the approved improvements with funding for the Swedish national inventory. Therefore, the ERT encourages Sweden to conduct the pertinent studies to develop and use the resulting country-specific parameters in its next annual submission.

Wastewater handling – CH_4

85. To estimate the CH_4 emissions from domestic and commercial wastewater treatment, Sweden has applied the simple check method from the IPCC good practice guidance with default parameter values. In the 2011 and 2012 annual review reports it was recommended that Sweden replace the IPCC check method with the default IPCC method (the full method from the Revised 1996 IPCC Guidelines), as it is appropriate for this key category. The ERT noted that Sweden has not addressed this recommendation in its 2013 annual submission. In response to a question raised by the ERT during the review, Sweden explained that this issue is included in the list of approved improvements for the Swedish national inventory and that the necessary funds have been provided. The ERT strongly recommends that Sweden use the IPCC default method as a result of this improvement in its next annual submission.

3. Non-key categories

Waste incineration – CO_2

86. In the 2013 annual submission, the complete time series of CO_2 emissions of biogenic and fossil origin for this category were revised based on a study performed in 2008 for the single waste incineration plant in the country that does not have energy recovery. The study concluded that 63 per cent of the total CO_2 emissions from this category have a biogenic origin (based on burned waste composition). This improvement was implemented in order to address a recommendation made in the previous review report. The ERT commends Sweden for this improvement.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

87. Table 6 provides an overview of the information reported and parameters selected by Sweden under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6
Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

		Findings and recommendations
Has Sweden reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Not sufficient	Sweden reported its national boundary as the boundary of the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (deforestation, afforestation, reforestation and forest management). However, during the review, Sweden confirmed the use of 31 strata (using county boundaries) as the geographical location of the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4. The ERT recommends that Sweden provide information, in the NIR of its next annual submission, on the county boundaries used as the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, in accordance with paragraph 6(b) of the annex to decision 15/CMP.1

		Findings and recommendations
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	Activities elected: forest management Years reported: 2008, 2009, 2010 and 2011	
Identify the period of accounting	Commitment period accounting	
Assessment of Sweden's ability to identify areas of land and areas of land-use change	Sufficient	Sweden reported that the spatial assessment unit is a permanent sample plot, which represents a certain area in the estimation algorithm so that all sample plots together represent the total land area of Sweden. Each sample plot has an identification code and a registered geographical position. The status of activities on the sample plots can be traced back from the current year to 1990, so land could only be reported under one activity or none. Sweden reported that all afforestation and reforestation land is connected with an active human decision (human-induced) and is, through national legislation, considered as forest land

Abbreviations: ERT = expert review team, NIR = national inventory report.

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2

88. The ERT noted that the reported area of land under afforestation and reforestation (263.85 kha for 2011) is higher that the reported area of managed land (cropland, grassland and settlements) converted to forest land reported under the LULUCF sector (246.92 kha for 2011). In response to a question raised by the ERT during the review, Sweden explained that the difference between the area under afforestation and reforestation and the area of managed land converted to forest land relates to the fact that two different extrapolation methods were used to estimate these areas in response to recommendations in the previous review report (see para. 76 above). However, since Sweden used the same definition for forest both for the LULUCF reporting and for the reporting of the KP-LULUCF activities, it is unlikely that the accounting areas under afforestation and reforestation activities are higher than the reported areas for managed land converted to forest land under the LULUCF sector, thus leading to a possible overestimation of CO_2 removals from land subject to afforestation and reforestation activities under Article 3, paragraph 3, of the Kyoto Protocol.

89. The ERT strongly recommends that Sweden review the implications of the use of two different extrapolation methods for the estimation of areas subject to the enhancement of stocks, provide consistent values for the land area subject to afforestation and reforestation activities under Article 3, paragraph 3, of the Kyoto Protocol and for the reported area of managed land (cropland, grassland and settlements) converted to forest land under the LULUCF sector and revise, if necessary, its estimates for afforestation and reforestation activities, in its next annual submission.

Deforestation – CO_2

90. Sweden defines deforestation as land-use conversion from forest land to cropland, grassland or settlements. This definition is consistent with the definition contained in the IPCC good practice guidance for LULUCF and the national definitions used for afforestation and reforestation.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

Forest management – CO_2

91. Sweden used the same methodology (tier 3) to estimate the carbon stock changes in living biomass for forest management and for forest land remaining forest land under the Convention. The carbon stock changes are estimated as the difference between two consecutive years and the linear interpolation method is used on a plot level between consecutive inventory measurements if no final felling is identified. The ERT notes that the reporting of this category is in line with the IPCC good practice guidance for LULUCF.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

92. Sweden has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.[9] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

93. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Calculation of the commitment period reserve

94. Sweden has reported its commitment period reserve in its 2013 annual submission. Sweden reported its commitment period reserve to be 307,244,703 t CO_2 eq based on the national emissions in its most recently reviewed inventory (61,448.94 Gg CO_2 eq). In response to a question raised by the ERT during the review week, Sweden reported its commitment period reserve to be 307,237,234 t CO_2 eq based on the revised emission estimates (submitted during the review week) in its most recently reviewed inventory (61,447.45 Gg CO_2 eq). The ERT agrees with this figure.

[9] The SEF comparison report is prepared by the international transaction log (ITL) administrator and provides information on the outcome of the comparison of data contained in Sweden's SEF tables with corresponding records contained in the ITL.

3. Changes to the national system

95. Sweden reported that there are no changes in its national system since the previous annual submission. The ERT concluded that the Sweden's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

96. Sweden reported that there are changes in its national registry since the previous annual submission. Sweden described the changes in its NIR as follows: in 2009, the EU member States who are also Parties to the Kyoto Protocol (25 countries in total) plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Sweden's registries, in particular decision 13/CMP.1 and decision 24/CP.8. At the time of the review, all EU registries, including the national registry of Sweden, are operated by the EU Commission using a single software in a consolidated platform called the Consolidated System of European Union Registries (CSEUR). Following the successful implementation of those changes, the 28 national registries concerned were recertified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all the relevant transaction and holdings data of the above-mentioned Parties were migrated to the CSEUR platform and the individual connections to and from the ITL were re-established for each Party.

97. The ERT noted the findings of the SIAR that the national registry of Sweden has not fulfilled the requirements regarding the public availability of information in accordance with section II.E of the annex to decision 13/CMP.1. In addition, the ERT noted that the SIAR identified three issues and their related recommendations regarding the national registry of Sweden following the implementation of the reported changes (see para. 96 above):

(a) Sweden provided public information as required by decision 13/CMP.1, annex, paragraph 44, with specific reference to paragraphs 45 and 46, which is not under the Party's direct control. Therefore, it was recommended that Sweden include public information directly on the website of the national registry or via a link from the registry website to another website controlled by the Party and that the publicly available information be kept up to date;

(b) Sweden did not fully report the changes in the national registry related to the description of the database structure. While Sweden has resubmitted a simplified data model during the assessment cycle, the information contained within the model is not sufficient, as evidenced by the lack of descriptions of each entity in the diagram and the omission of some diagram entities required in the technical standards for data exchange. Therefore, it was recommended that following any major changes, Sweden provide a complete data model containing all entities required in the technical data exchange standards (DES) with the descriptions of the database structure in the NIR of its future annual submissions;

(c) Sweden did not fully report the changes in the national registry related to the change of test results. While Sweden resubmitted the required information during the assessment cycle, the test report provided by the Party reveals a test plan which was of insufficient scope, as evidenced by the limited number of Kyoto Protocol processes covered and the absence of DES compliance demonstration through Annex H testing. Compliance with the DES requirements is essential to maintain confidence that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1. Therefore, it was strongly recommended that Sweden test each

release thoroughly against the DES requirements as part of each major release cycle and provide the complete results in the NIR of its future annual submissions.

98. During the review, in response to questions raised by the ERT regarding the actions taken to resolve the issues identified in the SIAR, Sweden indicated that actions are ongoing to resolve the first issue identified in the SIAR through the development of software that will periodically collect the information required by decision 13/CMP.1, annex, paragraph 44, from the CSEUR platform, store this information and make it available to the public from the servers located in Sweden. The Party also indicated that the new software will be implemented before the end of 2013. The ERT recommends that Sweden implement the necessary above-mentioned actions as soon as possible, in order to resolve this issue prior to its next annual submission. In its comments to the draft review report, Sweden informed the ERT that it has included the public information on a website controlled by the Party. The publicly available information is updated as close to real time as possible, but at least on a monthly basis.

99. With regard to the second and third recommendations of the SIAR that are highly technical and valid for all Parties that use CSEUR, Sweden provided the ERT with the document "Information on changes in the national registry of the annual inventory submission for the reporting year 2012. The two sections are prepared for Parties as a reply to address the following recommendations in the SIAR" elaborated by the EU Commission and provided to the ERT as a second addendum to chapter 14 of the 2013 NIR. The document contains the additional documentation as indicated in the recommendations contained in the SIAR. The ERT recommends that Sweden include such information in its next annual submission and make efforts to ensure that the successful implementation of the two above-mentioned recommendations becomes a priority for CSEUR. In its comments to the draft review report, Sweden informed the ERT that it will make efforts to ensure that the successful implementation of the SIAR recommendations becomes a priority for CSEUR and the EU Commission, and will prompt the EU Commission on this matter.

100. The ERT concluded that, taking into account the confirmed changes in the national registry, Sweden's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). The ERT recommends that Sweden fully report, in its next annual submission, any change(s) in its national registry in accordance with decision 15/CMP.1, annex, chapter I.G.

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

101. Sweden did not provide information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its 2013 annual submission. However, as in the previous annual submission, Sweden reported detailed information on the minimization of adverse impacts in accordance with the requirements outlined in decision 15/CMP.1, annex, paragraphs 23 and 24. The ERT did not note any change in this information since the previous annual submission. Therefore, the ERT concluded that the reported information continues to be complete and transparent. The ERT recommends that the Party, in its next annual submission, report any change(s) in its information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H.

102. In its NIR, Sweden elaborated on the variety of measures in place to minimize adverse social, environmental and economic impacts, including: the use of environmental

impact assessments in the decision-making process; research contributing to a sustainable global development; technology transfer, capacity-building and support for adaptation measures; and the provision of financial support to developing countries. The national climate strategy, which contains a wide range of measures across all sectors, is also considered to minimize the risk of adverse effects.

103. Sweden has also provided the information on how it gives priority to the actions set out in decision 15/CMP.1, annex, paragraph 24, indicating that it has, to a large extent, reformed energy markets and phased out market imperfections; deregulated market price on electricity governed by the balance between demand and supply on a cross-border electricity market; and implemented a CO_2 tax on fossil fuels that is levied as a cost on fuels used outside the EU ETS. Sweden does not extract oil, natural gas or coal and, therefore, has no subsidy for fossil fuel extraction. Sweden also assists developing countries with the transfer of energy-efficient technologies, renewable energy technologies, capacity-building and clean development mechanism projects. Lastly, Sweden intends to participate in the field of multilateral research collaborations, especially in CO_2 capture and storage.

III. Conclusions and recommendations

A. Conclusions

104. Table 7 summarizes the ERT's conclusions on the 2013 annual submission of Sweden, in accordance with the Article 8 review guidelines.

Table 7
Expert review team's conclusions on the 2013 annual submission of Sweden

		Paragraph cross-references
The ERT concludes that the inventory submission of Sweden is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		
Annex A sources[a]	Complete	
LULUCF[a]	Complete	
KP-LULUCF	Complete	
The ERT concludes that the inventory submission of Sweden has been prepared and reported in accordance with the UNFCCC reporting guidelines	Yes	
The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1	No	Not sufficient for the KP-LULUCF activities (see table 6 above)
Sweden's inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*	Yes	
Sweden has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Yes	91

		Paragraph cross-references
Sweden has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1	Yes	
The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions	Yes	
Did Sweden provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol?	No	101–103

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

105. The ERT identified the issues for improvement listed in table 8 below. All recommendations are for the next annual submission, unless otherwise specified.

Table 8
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph references*
Cross-cutting	National system	Improve the national system in a way that would enable it to implement the recommendations provided in the annual review reports in time for the next annual submission	12
	Uncertainty	In the waste sector, further investigate the uncertainty of country-specific parameters and EFs used and improve the uncertainty analysis	Table 4
	Follow-up to previous reviews	Implement all pending recommendations from the 2011 and 2012 annual review reports and include the relevant information	16, 17 and 18
Energy	Transparency	Appropriately explain in the NIR the reasons for the use of a particular database for the various inventory categories and, if various data sets are used, how these data sets are reconciled, and why a specific database is chosen to estimate the national GHG inventory emissions	27 and 28

Sector	*Category*	*Recommendation*	*Paragraph references*
		for a particular category	
	Reference and sectoral approaches	Minimize the differences in the energy balance between the reference and sectoral approaches so as to reduce the differences in the emission estimates between the two approaches, in accordance with the Revised 1996 IPCC Guidelines	31 and 32
	Stationary combustion–CO_2	Provide detailed energy and carbon mass balances for the iron and steel industry in the NIR, and also make this a regular feature in the NIR of future annual submissions	38
		Include information and explanations regarding the use and trends of liquid fuels in the commercial/institutional category	40
Industrial processes and solvent and other product use	Transparency	Elaborate in the NIR on which data are derived from which source and on the methodology used when the emissions are directly derived from company environmental reports, especially for the key categories	45
		Further enhance transparency through the provision of background information on some categories in the NIR, especially when large emission reductions occur, or when gases are collected/destructed	45
	Cement production – CO_2	Include information in the NIR on the composition of the raw material and on the bypass and cement kiln dust	49
	Nitric acid production – N_2O	Elaborate on the information related to the emission estimation method and abatement technology used	51
	Iron and steel production – CO_2	Provide detailed energy and carbon mass balances for the two integrated iron and steel production plants and corresponding explanations with a clear indication of where in the CRF tables the associated emissions are reported	52–54
	Consumption of halocarbons and SF_6 – HFCs	Obtain further confirmation regarding the HFC collection/destruction regulation and its coverage, ascertain what data may be available for use in the inventory, and incorporate those findings in the NIR	56
		Describe in the NIR the equipment for which lower annual leakage rates are assigned and the criteria used to select them	57
		Reassess the use of the notation key "NA" and change the notation key reported to "NO", where relevant	58
	Limestone and dolomite use – CO_2	Report the emissions from this category under the subcategory for limestone and dolomite use, or explain in the NIR how the completeness of the reporting is still ensured	59 and 60

Sector	*Category*	*Recommendation*	*Paragraph references*
Agriculture	Transparency	Implement pending recommendations from the previous review report, in particular regarding the STANK model, including the information provided during the review	64
	Manure management – CH_4	Include the information provided to the ERT regarding the reasons for the fluctuations in the CH_4 IEFs for the years 1998–1999	66
	Agricultural soils – N_2O	Recalculate the estimates of N_2O emissions from N-fixing crops and from crop residue using actual crop yields for the entire time series	67
		Include detailed information on the country-specific EF used for animal manure applied to soils	68
LULUCF	QA/QC	Improve the QC procedures and report the correct estimates in a consistent manner in the NIR and the CRF tables	70
	Transparency	Include detailed information on the rationale for and the impact of the recalculations at the category- and pool-specific level	72
		Provide explanations on the impacts of the recalculations and how they affect the uncertainty estimates, which is related to the methodology used to estimate uncertainty and the stability of the accuracy in absolute terms	74
	Forest land – CO_2	Provide information on the use of stratification for estimating carbon stock changes based on random sampling, including a description of the procedure for summing estimates over strata up to the national scale and how it improves the estimates	75
		Report additional information explaining how the extrapolation (based on five-year rolling averages) is applied to living biomass and to the areas for which insufficient data have been obtained from the NFI cycles for each category of land converted to forest land	76
	Cropland – CO_2	Provide information on the drivers of the inter-annual fluctuations in CO_2 emissions from cropland remaining cropland	77
	Cropland – N_2O	Make efforts to find locally-specific C/N ratios based on measurements of SOC to improve the accuracy of the N_2O emission calculations using a tier 2 method	78
Waste	Transparency	Provide a flow chart for the different waste treatment types and the corresponding AD distribution between them	81
	Wastewater handling – CH_4	Use the IPCC default method as a result of planned improvement	85
KP-LULUCF	General	Provide information in the NIR on the county boundaries used as the areas that encompass units of land subject to activities under Article 3, paragraphs 3 and 4, of the	Table 6

Sector	*Category*	*Recommendation*	*Paragraph references*
		Kyoto Protocol, in accordance with paragraph 6(b) of the annex to decision 15/CMP.1	
	Afforestation and reforestation – CO_2	Review the implications of the use of two different extrapolation methods for the estimation of areas subject to the enhancement of stocks, provide consistent values for the land area subject to afforestation and reforestation activities under Article 3, paragraph 3, of the Kyoto Protocol and for the reported area of managed land (cropland, grassland and settlements) converted to forest land under the LULUCF sector and revise, if necessary, its estimates for afforestation and reforestation activities	88, 89
National registry	Changes to the national registry	Implement the development of software that will periodically collect the information required by decision 13/CMP.1, annex, paragraph 44, from the CSEUR platform, store this information and make it available to the public from the servers located in Sweden	98
		Provide the information on changes in the national registry of the annual inventory submission for the reporting year 2012 elaborated by the EU Commission and make efforts to ensure that the successful implementation of the SIAR recommendations becomes a priority for CSEUR	99
Article 3, paragraph 14, of the Kyoto Protocol	General	Report any change(s) in the information provided under Article 3, paragraph 14	101

Abbreviations: AD = activity data, C = carbon, CRF = common reporting format, CSEUR = Consolidated System of European Union Registries, DOM = death organic matter, EF = emission factor, ERT = expert review team, FOD = first order decay, GHG = greenhouse gas, IEF – implied emission factor, IPCC = Intergovernmental Panel on Climate Change, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, N = nitrogen, NA = not applicable, NIR = national inventory report, NO = not occurring, QA/QC = quality assurance/quality control, SOC = soil organic carbon.

IV. Questions of implementation

106. No questions of implementation were identified by the ERT during the review.

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 9
Recalculations in the 2013 annual submission for the base year and the most recent year

	1990	*2010*	*1990*	*2010*	
Greenhouse gas source and sink categories	*Value of recalculation (Gg CO_2 eq)*		*Per cent change*		*Reason for the recalculation*
1. Energy	63.25	–487.32	0.10	–0.99	Improved AD and EFs, reallocation of emissions
A. Fuel combustion (sectoral approach)	55.18	–503.04	0.10	–1.04	
1. Energy industries		–0.34		–0.003	
2. Manufacturing industries and construction	22.05	32.84	0.18	0.32	
3. Transport	–3.36	–217.55	–0.02	–1.05	
4. Other sectors	1.70	–317.19	0.02	–7.48	
5. Other	34.79	–0.81	4.20	–0.46	
B. Fugitive emissions from fuels	8.07	15.73	2.14	1.60	
1. Solid fuels					
2. Oil and natural gas	8.07	15.73	2.17	1.60	
2. Industrial processes		–30.30		–0.44	Removal of double counting, improved AD
A. Mineral products		–26.59		–1.28	
B. Chemical industry					
C. Metal production		1.19		0.04	
D. Other production					
E. Production of halocarbons and SF_6					
F. Consumption of halocarbons and SF_6		–4.90		–0.55	
G. Other					
3. Solvent and other product use		–22.18		–7.13	
4. Agriculture	–117.81	–129.88	–1.29	–1.64	Improved AD, methodological changes
A. Enteric fermentation	–119.78	–124.88	–3.90	–4.60	
B. Manure management	0.39	1.14	0.04	0.15	
C. Rice cultivation					
D. Agricultural soils	1.58	–6.14	0.03	–0.14	
E. Prescribed burning of savannas					
F. Field burning of agricultural residues					

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
G. Other					
5. Land use, land-use change and forestry	4 075.01	3 354.73	–9.88	–9.85	Improved AD, methodological changes
A. Forest land	3 514.74	2 472.89	–7.98	–6.49	
B. Cropland	–8.35	342.07	–0.34	18.23	
C. Grassland	614.31	694.45	–67.07	–90.74	
D. Wetlands					
E. Settlements	–45.68	–154.68	–3.72	–5.40	
F. Other land					
G. Other					
6. Waste	0.0005	–50.27	0.00001	–2.72	Improved AD, methodological changes, reallocation of emissions
A. Solid waste disposal on land		3.52		0.27	
B. Wastewater handling		–5.70		–1.24	
C. Waste incineration	0.0005	–48.08	0.001	–44.09	
D. Other					
7. Other					
Total CO_2 equivalent without LULUCF	–54.56	–719.94	–0.07	–1.09	
Total CO_2 equivalent with LULUCF	4 020.45	2 634.79	12.74	8.18	

Abbreviations: AD = activity data, EFs = emission factors, LULUCF = land use, land-use change and forestry.

Table 10

Information to be included in the compilation and accounting database in t CO_2 eq for 2011, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	307 244 703	307 237 234		307 237 234
Annex A emissions for 2011				
CO_2	48 725 690			48 725 690
CH_4	4 984 891			4 984 891
N_2O	6 681 551	6 680 057		6 680 057
HFCs	813 420			813 420
PFCs	182 954			182 954
SF_6	60 435			60 435
Total Annex A sources	61 448 941	61 447 447		61 447 447
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	–897 966			–897 966
3.3 Afforestation and reforestation on harvested land for 2011	NO			NO
3.3 Deforestation for 2011	2 555 133			2 555 133
Activities under Article 3, paragraph 4, for 2011[c]				
3.4 Forest management for 2011	–37 585 862			–37 585 862
3.4 Cropland management for 2011				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2011				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

Abbreviation: NO = not occurring.

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 11
Information to be included in the compilation and accounting database in t CO_2 eq for 2010

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2010				
CO_2	52 302 445	52 368 555		52 368 555
CH_4	5 076 187	5 076 197		5 076 197
N_2O	7 032 720	7 030 631		7 030 631
HFCs	845 243			845 243
PFCs	158 212			158 212
SF_6	72 587			72 587
Total Annex A sources	65 487 394	65 551 425		65 551 425
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	–899 219			–899 219
3.3 Afforestation and reforestation on harvested land for 2010	NO			NO
3.3 Deforestation for 2010	2 536 117			2 536 117
Activities under Article 3, paragraph 4, for 2010[c]				
3.4 Forest management for 2010	–33 613 558			–33 613 558
3.4 Cropland management for 2010				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2010				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

Abbreviation: NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 12
Information to be included in the compilation and accounting database in t CO_2 eq for 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	46 404 789	46 518 441		46 518 441
CH_4	5 169 796	5 169 813		5 169 813
N_2O	6 778 828	6 803 069		6 803 069
HFCs	868 523			868 523
PFCs	35 330			35 330
SF_6	80 529			80 529
Total Annex A sources	59 337 794	59 475 705		59 475 705
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	–915 042			–915 042
3.3 Afforestation and reforestation on harvested land for 2009	NO			NO
3.3 Deforestation for 2009	2 771 659			2 771 659
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–35 454 695			–35 454 695
3.4 Cropland management for 2009				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2009				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

Abbreviation: NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 13
Information to be included in the compilation and accounting database in t CO_2 eq for 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2008				
CO_2	50 005 526			50 005 526
CH_4	5 269 833			5 269 833
N_2O	6 956 313	6 955 076		6 955 076
HFCs	866 619			866 619
PFCs	225 048			225 048
SF_6	83 869			83 869
Total Annex A sources	63 407 207	63 405 971		63 405 971
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	–884 514			–884 514
3.3 Afforestation and reforestation on harvested land for 2008	NO			NO
3.3 Deforestation for 2008	2 996 173			2 996 173
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–35 687 994			–35 687 994
3.4 Cropland management for 2008				
3.4 Cropland management for the base year				
3.4 Grazing land management for 2008				
3.4 Grazing land management for the base year				
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

Abbreviation: NO = not occurring.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Annex II

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental P nel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Sweden 2013. Available at <http://unfccc.int/resource/docs/2013/asr/swe.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2013. Available at <http://unfccc.int/resource/webdocs/sai/2013.pdf>.

FCCC/ARR/2012/SWE. Report of the individual review of the greenhouse gas inventory of annual submission of Sweden submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/swe.pdf>.

UNFCCC. *Standard Independent Assessment Report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Maria Liden (Swedish Environmental Protection Agency), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Sweden:

Carina Ortiz. "Soil organic carbon stock changes in Swedish forest soils – A comparison of uncertainties and their sources through a national inventory and two simulation models". Ecological Modelling. December 2012.

Göran Ståhl. "Sample-Based Estimation of Greenhouse Gas Emissions From Forests – A New Approach to Account for Both Sampling and Model Errors". Abstract. August 29, 2013.

Johannes Breidenbach. "Quantifying the Model-Related Variability of Biomass Stock and Change Estimates in the Norwegian National Forest Inventory". Abstract. July 11, 2013.

Joint Implementation Supervisory Committee, "Joint Implementation Project Design Document Form Version 01, N_2O Abatement Project in Sweden – Plant 2". September 2011.

Joint Implementation Supervisory Committee, "Joint Implementation Project Design Document Form Version 01, N_2O Abatement Project in Sweden – Plant 3". September 2011.

Nitric acid production information for Yara Ab Köping (plant). (Confidential).

SEPA. "Näringsbelastningen pä Östersjön och Västerhavet 2006". Nutrient pressures on the Baltic Sea and the Western Sea 2006. Nitrogen and Phosphorus balances for Agriculture Land (Use of fertilizer and animal manure in agriculture). Report 5815. May 2008.

SEPA and SMED. "Using extrapolation to improve estimates for the most recent years in the Swedish greenhouse gas reporting under the UNFCCC and the Kyoto Protocol". The Land Use, Land-Use Change, and Forestry Sector. September 2013.

SMED. "Kvalitetskontroll av emissionsfaktorer för stationär förbränning". February 28, 2012. NIR 2012, Annex I.

SMED. "Manual for SMED's Quality System in the Swedish Air Emission Inventories". January 29, 2013. SMED Report No 132 2013.

SMED Report No. 125 2013, "Differences between Eurostat and CRF data in Swedish Reporting" (A comparative study of data on fuel consumption in 2005-2011 reported by Sweden to Eurostat and UNFCCC). Contract no 2250-13-003.

SMED Report, "Quality Assurance of Calculations for Reference Approach", December 2012.

Statistics Sweden. Energy and fuel statistics. February 27, 2013.

Sverige mot minskad klimatpåverkan. Swedish EPA. Report 4786, 1997. Page 21.

[1] Reproduced as received from the Party.

Annex III

Acronyms and abbreviations

AD	activity data
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CaO	calcium oxide
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CSEUR	Consolidated System of European Union Registries
DES	data exchange standards
DOM	dead organic matter
EF	emission factor
ERT	expert review team
ETS	emissions trading system
EU	European Union
F-gas	fluorinated gas
FOD	first order decay
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kha	kilohectare
kg	kilogram (1 kg = 1,000 grams)
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
m^3	cubic metre
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	national forestry inventory
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SEPA	Swedish Environmental Protection Agency
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SMED	Swedish Environmental Emissions Data
SOC	soil organic carbon
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change